

1 WHAT IS CLAIMED IS:

2
3 1. A microporous membrane for use in separation processes, said microporous membrane
4 comprising domains of a first polymer component uniformly distributed in a matrix of a second
5 polymer component, said second polymer component matrix comprising a three-dimensional
6 network of uniformly distributed, interconnected microcracks of uniform dimension having a
7 mean pore size of about 1 nanometer to about 200 nanometers and having a porosity of about 5
8 percent to about 40 percent, said membrane prepared from a film-forming composition, said
9 film-forming composition consisting essentially of a mixture of

10 a first polymer component in an amount of from about 1 percent by weight to about 25
11 percent by weight, and

12 a second polymer component immiscible with said first polymer component and blended
13 therewith, said second polymer component present in an amount ranging from about 65 percent
14 by weight to about 99 percent by weight.

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16 2. The microporous film of claim 1 wherein said mean pore size of said microcracks is about 1 to
17 about 10 nanometers.

18
19 3. The microporous film of claim 1 wherein said mean pore size of said microcracks is about 10 to
20 about 20 nanometers.

21
22 4. The microporous film of claim 1 wherein said first and second polymer components are
23 independently selected from amorphous, semicrystalline, hydrophilic or hydrophobic.

- 1 5. The microporous film of claim 1 wherein said first and second polymer components are
2 independently selected from a polyolefin, polystyrene or a polyester
3
- 4 6. The microporous film of claim 5 wherein said polyolefin is polypropylene, polyethylene, or
5 poly(4-methyl-1-pentene).
6
- 7 7. The microporous film of claim 1 wherein said first polymer component is 15 percent by weight
8 poly(ethylene terephthalate) and said second polymer component is 85 percent by weight
9 polypropylene.
10
- 11 8. The microporous film of claim 1 wherein said first polymer component is 10 percent by weight
12 polystyrene and said second polymer component is 90 percent by weight polypropylene.
13
- 14 9. The microporous film of claim 1 further comprising about 0.5 percent to about 25 percent by
15 weight of a compatibilizing block copolymer.
16
- 17 10. The microporous film of claim 9 wherein said compatibilizing block copolymer is SEEPS, said
18 first polymer is polystyrene and said second polymer is polypropylene.
19
- 20 11. The microporous film of claim 10 comprising about 10% by weight polystyrene, 90% by weight
21 polypropylene, and about 5 percent by weight thereof SEEPS.
22
- 23 12. The microporous film of claim 10 comprising about 15% by weight polystyrene, 85% by weight
24 polypropylene, and about 7.5 percent by weight thereof SEEPS.

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2 13. A method for the preparation of a microporous membrane useful in separation processes, said
3 microporous membrane comprising domains of a first polymer component uniformly distributed
4 in a matrix of a second polymer component, said second polymer component matrix comprising
5 a three-dimensional network of uniformly distributed, interconnected microcracks of uniform
6 dimension having a mean pore size of about 1 nanometer to about 200 nanometers and having a
7 porosity of about 5 percent to about 40 percent, said method comprising:

8 A. preparing a film-forming composition, said film forming composition consisting
9 essentially of a mixture of

10 a first polymer component in an amount of from about 1 percent by weight to about 35
11 percent by weight,

12 a second polymer component immiscible with said first polymer component and blended
13 therewith, said second polymer component present in an amount ranging from about 65 percent
14 by weight to about 99 percent by weight;

15 B. preparing a film from the composition of step A; and

16 C. subjecting the film prepared in step B to a stretching procedure whereby said film is stretched
17 at least 100% beyond the unstretched dimensions,
18 whereby the final microporous membrane is formed.

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20 14. The method of claim 13 wherein said film is prepared by a casting process.

21
22 15. The method of Claim 13 wherein said film is prepared by spray application of said composition
23 to a substrate.
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- 1 16. The method of Claim 13 wherein said film is prepared by extrusion.
- 2
- 3 17. The method of Claim 13 wherein said stretching procedure comprises a first cold stretching step
- 4 followed by at least one hot stretching step.
- 5
- 6 18. The method of Claim 17 wherein said cold stretching step is performed at a temperature of from
- 7 about 15 C to about 25 C, and said film is thereby stretched to from about 20% to about 30%
- 8 above its original dimension.
- 9
- 10 19. The method of Claim 17 wherein said hot stretching step is performed at a temperature ranging
- 11 from about 10 C to about 15 C below the glass transition temperature of the first polymer
- 12 component, said hot stretching performed to the attainment of a final dimension ranging from
- 13 about 100% to about 400% of the original dimension of the unstretched film.
- 14
- 15 20. The method of claim 17 wherein said film is further treated by annealing under tension at a
- 16 temperature of about 5 C to about 10 C higher than the hot stretching step, but below the glass
- 17 transition temperature of said first polymer component.
- 18
- 19 21. The method of claim 13 wherein said mixture further comprises a compatibilizing block
- 20 copolymer.
- 21
- 22 22. The method of Claim 21 wherein said film forming composition is prepared by the simultaneous
- 23 mixture of said polymer components.
- 24

- 1 23. The method of Claim 21 wherein said film forming composition is prepared by the premixture of
2 said first polymer component and said compatibilizing block copolymer, and the subsequent
3 mixture thereof with said second polymer component.
4
- 5 24. The process of claim 21 wherein said film is prepared by a casting process.
6
- 7 25. The method of Claim 21 wherein said film is prepared by spray application of said composition
8 to a substrate.
9
- 10 26. The method of Claim 21 wherein said film is prepared by extrusion.
11
- 12 27. The method of Claim 21 wherein said stretching procedure comprises a first cold stretching step
13 followed by at least one hot stretching step.
14
- 15 28. The method of Claim 27 wherein said cold stretching step is performed at a temperature of from
16 about 15 C to about 25 C, and said film is thereby stretched to from about 20% to about 30%
17 over its original dimension.
18
- 19 29. The method of Claim 27 wherein said hot stretching step is performed at a temperature ranging
20 from about 10 C to about 15 C below the glass transition temperature of the first polymer
21 component, said hot stretching performed to the attainment of a final dimension ranging from
22 about 100% to about 700% of the original dimension of the unstretched film.
23

1 30. The method of claim 27 wherein said film is further treated by annealing under tension at a
2 temperature of about 5 C to about 10 C higher than the hot stretching step, but below the glass
3 transition temperature of said first polymer component.
4

5 31. A microporous membrane for use in separation processes, said microporous membrane
6 comprising domains of a first polymer component uniformly distributed in a matrix of a second
7 polymer component, said second polymer component matrix comprising a three-dimensional
8 network of uniformly distributed, interconnected microcracks of uniform dimension with a mean
9 pore size of about 1 nanometer to about 200 nanometers and a porosity of about 5 percent to
10 about 40 percent, said microporous membrane prepared by the steps of:

11 A. preparing a film-forming composition, said film forming composition consisting
12 essentially of a mixture of

13 a first polymer component in an amount of from about 1 percent by weight to about 35
14 percent by weight,

15 a second polymer component immiscible with said first polymer component and blended
16 therewith, said second polymer component present in an amount ranging from about 65 percent
17 by weight to about 99 percent by weight;

18 B. preparing a film from the composition of step A; and

19 C. subjecting the film prepared in step B to a stretching procedure whereby said film is stretched
20 at least 100% beyond the unstretched dimensions,
21 whereby the final microporous membrane is formed.
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23 32. The microporous membrane of claim 31 wherein said film is prepared by a casting process.
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- 1 33. The microporous membrane of Claim 31 wherein said film is prepared by spray application of
2 said composition to a substrate.
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- 4 34. The microporous membrane of Claim 31 wherein said film is prepared by extrusion.
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- 6 35. The microporous membrane of Claim 31 wherein said stretching procedure comprises a first cold
7 stretching step followed by at least one hot stretching step.
8
- 9 36. The microporous membrane of Claim 35 wherein said cold stretching step is performed at a
10 temperature of from about 15 C to about 25 C, and said film is thereby stretched to from about
11 20% to about 30% of its original dimension.
12
- 13 37. The microporous membrane of Claim 35 wherein said hot stretching step is performed at a
14 temperature ranging from about 10 C to about 15 C below the glass transition temperature of the
15 first polymer component, said hot stretching performed to the attainment of a final dimension
16 ranging from about 100% to about 400% of the original dimension of the unstretched film.
17
- 18 38. The microporous membrane of claim 35 wherein said film is further treated by annealing under
19 tension at a temperature of about 5 C to about 10 C higher than the hot stretching step, but below
20 the glass transition temperature of said first polymer component.
21
- 22 39. The microporous membrane of claim 31 wherein said mixture further comprises a
23 compatibilizing block copolymer.
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- 1 40. The microporous membrane of Claim 39 wherein said film forming composition is prepared by
2 the simultaneous mixture of said polymer components.
3
- 4 41. The microporous membrane of Claim 39 wherein said film forming composition is prepared by
5 the premixture of said first polymer component and said compatibilizing block copolymer, and
6 the subsequent mixture thereof with said second polymer component.
7
- 8 42. The microporous membrane of claim 39 wherein said film is prepared by a casting process.
9
- 10 43. The microporous membrane of Claim 39 wherein said film is prepared by spray application of
11 said composition to a substrate.
12
- 13 44. The microporous membrane of Claim 39 wherein said film is prepared by extrusion.
14
- 15 45. The microporous membrane of Claim 39 wherein said stretching procedure comprises a first cold
16 stretching step followed by at least one hot stretching step.
17
- 18 46. The microporous membrane of Claim 45 wherein said cold stretching step is performed at a
19 temperature of from about 15 C to about 25 C, and said film is thereby stretched to from about
20 20% to about 30% of its original dimension.
21
- 22 47. The microporous membrane of Claim 45 wherein said hot stretching step is performed at a
23 temperature ranging from about 10 C to about 15 C below the glass transition temperature of the

first polymer component, said hot stretching performed to the attainment of a final dimension ranging from about 100% to about 700% of the original dimension of the unstretched film.

48. The microporous membrane of claim 45 wherein said film is further treated by annealing under tension at a temperature of about 5 C to about 10 C higher than the hot stretching step, but below the glass transition temperature of said first polymer component.